The Distribution of 1,000 Fleas of the Genus Xenopsylla Taken in Tanganyika During 1961–1963

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From September 15, 1961 to May 15, 1963 the writer collected close to 1,000 fleas belonging in the genus *Xenopsylla* off various native rats and mice in Tanganyika, East Africa. The genus is known the world over because of the presence in it of *cheopis*, the chief vector of bubonic plague. In Africa there are more representatives of the genus than elsewhere for about 50 of the some 75 known from the world beset the collector. These fleas are small, generally numerous, and a nuisance to determine.

During the two-year study eleven representatives of the genus were found, four of which were new and described as such. A twelfth, described long before, was not recovered, and a thirteenth had been described far to the south in an area in which the writer had not collected.

The **Xenopsylla cheopis, bantorum, versuta** Complex

The members of this complex are so alike that the greatest amount of acumen and study are required to separate them one from the other. All were listed by the writer as *X. cheopis* in "Fleas From 1,001 Mice Taken in N.E. Tanganyika," *E.A. Med. Jour.* 40: 9. Subsequent study of these fleas by the specialists at the Tring Branch of the British Museum separated them into their proper categories.

Xenopsylla cheopis (Rothschild), 1903.

This flea was described from specimens taken off *Acomys witherbyi* (Spiny Mouse) near Shendi, the Sudan. It is probably the best known of the genus for it is world-wide in distribution. It has been known in Tanganyika since 1915, Vogeler having collected it off "Epimys" at Dar-es-Salaam on

January 14. Loveridge collected the flea at Morogoro off "Rattus" during December of 1916 and Verdcourt took it at Amani during July 1950, the host not mentioned.

In the writer's study this flea was not found in any numbers until after the middle of July 1962. Before this date the flea was a rarity in his collections, after this date it seemed to explode in numbers everywhere.

At Amani, 3,000 feet up in the Eastern Usambara Mountains, this flea was found on *Rattus rattus kijabius* (Black Rat) sparingly. The rats were taken along creeks, on farms and plantations, and in the houses, and were a nuisance in the laboratories, gaining entrance into them through the pipe tunnels. These rats seemed clean as far as fleas were concerned. Many of them and a series of their nests, some with young were without fleas when examined. Some of the rats carried one or two. On April 13, 1963, however, four small young taken in the laboratory carried 3, 5, 7, and 10 each.

From Amani, working westward, that is, inland from the Indian Ocean at Mamba, 5,000 feet up in the South Pare Mountains, a female of this flea was taken off *Lophuromys flavopunctatus margarettae* (Chocolate Brown Mouse) on November 10, 1962. This was doubtless an accidental occurrence since hundreds of other specimens of this mouse examined did not carry it.

At Same, 2,200 feet, in flat land and 150 or so miles west of the Indian Ocean, in the compound of the Malaria Institute laboratory and resthouse there was a large number of *Arvicanthis abyssinicus virescens* (Grass Mouse) in the grass of the two-acre tract from July through December of 1962. The first rains in late December caused the mice to disperse and they vanished from the tract. The mice were examined each month of the period and were carrying this flea during the entire season. The records were: July 15 one mouse with 2 ♂♂, 4 ♀♀; August 1, one mouse with 1 ♂, 3 ♀♀; September 28, one mouse with 10 ♂♂, 18 ♀♀; October 15, 3 mice with 15 each; November 9, 2 mice with 12 each; December 22, one mouse with 1♂, 5 ♀♀. Numbers of other grass- and seed-eating mice were using the Grass Mouse trails but none were carrying this flea at the time of examination.

At Moshi, 2,400 feet in flat land and some 200 miles inland from the Indian Ocean on October 13, 1962, a specimen of this mouse carried 6 pairs of this flea.

At Arusha, 4,500 feet in flat land and some 250 miles inland from the Indian Ocean on February 7, 1963 this flea was carried by the following mice: *Arvicanthis abyssinicus virescens,* 3 ♂♂, 4 ♀♀. *Mastomys natalensis hildebrandti* (Coucha Rat), 10 specimens carried 55; *Rhabdomys pumilio diminutus* (Four-stripe Grass Mouse), 2 ♀♀.

At Lake Manyara National Park, 3,000 feet in the Rift Valley and some 300 miles inland from the Indian Ocean, on January 15, 1963 two specimens of (Single-stripe Grass Mouse) *Lemniscomys griselda rosalia* carried 55 of these fleas and a single specimen of *Arvicanthis abyssinicus pallidus* (Pallid Grass Mouse) carried 42.

In so far as this flea was found in Entebbe, Uganda, on the north shore of Lake Victoria as early as 1911 it seems likely it will be found in the Tanganyika ports of the lake also.

Xenopsylla bantorum Jordan, 1938.

This flea was described off *Acthomys* (Bush Rat) taken at Tororo, Uganda. There are other records from Uganda and several from Kenya. This flea has not been reported out of East Africa. The writer's records are from north-central Tanganyika.

Working at Seronera, the Serengeti, at about 5,000 feet, the first week in October 1962 all mice taken carried this flea, many in large numbers. The hosts were: *Arvicanthis abyssinicus muansae* (Grass Mouse). These were so plentiful that they could be seen darting about everywhere. Ten specimens examined the morning of October 4 carried 40 ♂♂ and 60 ♀♀ of this flea, and 6 examined during the afternoon carried 25 pairs. *Lemniscomys striatus* (Striated Grass Mouse), 2 on October 4 carried 15 each. *Steatomys athi* (Fat Mouse), one specimen carried 2 ♂♂, 4 ♀♀ on October 6. *Saccostomus campestris umbriventer* (Pouched Mouse), 2 carried 12 pair on October 6. *Thallomys damarensis scotti* (Masked Mouse), one

with 2 ♂♂, 4 ♀♀ on October 6. *Mus* (*Leggeda*) *triton* (Pigmy Mouse), one with 1 ♂, 2 ♀♀ on October 5. *Tatera robusta muansae* (Big Gerbil), one with one ♂ on October 4. *Mastomys natalensis victoriae* (Coucha Rat), 20 specimens examined during the week carried many of these fleas.

At Olalaa located midway between the Serengeti and Lake Natron at about 5,000 feet in hilly country, on October 3, this flea was removed from: *Steatomys athi* (Fat Mouse), one specimen carrying 1 ♂ and 2 ♀♀. *Tatera robusta pothae* (Big Gerbil), 6 specimens carrying 1 ♂ and 6 ♀♀. *Mastomys natalensis victoriae* (Coucha Rat), one specimen carrying 1 ♀.

Xenopsylla versuta Jordan, 1925.

This flea was described from Angola off *Funisciurus* (Squirrel) which was collected in 1906. It is also known from Uganda, Kenya, and Southwest Africa.

At Seronera, the Serengeti, the flea was taken on October 6, 1962 off *Thallomys damarensis scotti* (Masked Mouse), 2 ♀♀; and at Lake Manyara National Park, October 8, 1962 off *Thamnomys dolichurus surdaster* (African Tree Mouse), 2 ♂♂, 3 ♀♀; and on January 19, 1963 off *Mastomys natalensis hildebrandti*, a ♀. At Arusha on February 2, 1962 off *Graphiurus murinus isolatus* (African Dormouse), a ♂, and on October 1, 1962 off *Mastomys natalensis durumae*, a ♂. At Same, June 15, 1962 off *Xerus rutilus* (Ground Squirrel), 2 females; and at Gonja on November 8, 1962 off *Aethomys chrysophilus voi* (Bush Rat), a ♂ and a ♀.

Xenopsylla nubica (Rothschild), 1903.

This flea belongs in this position. It is of the group of *cheopis*-like fleas but can readily be distinguished from the three above. It was described from specimens taken off the Grass Mouse *Arivcanthis* at Shendi, the Sudan. The flea is well known from Egypt, the Sudan and from a swath through central Africa. Here, however, are the first records from Tanganyika. *Tatera robusta swaythlingi* and *Tatera nigricauda nyama* (Big

Gerbil and Blacktailed Gerbil), off each a female on November 12, 1962 at Gonja.

The **Xenopsylla brasiliensis, morgandaviesi, robertsi** Complex

These fleas, in the female, may be distinguished from one another in the amount of bulb at the base of the tail of the spermatheca, *brasiliensis* having quite a bulb, *morgandaviesi* a small bulb, *robertsi* hardly any at all. The males can be separated by small differences in the genitalia. *X. robertsi* was described by Jordan in 1936 from central Kenya off black rats. There are as yet no Tanganyika or Uganda records.

Xenopsylla brasiliensis (Baker), 1904.

Although this flea was described from Brazil it seems today to be a native of Africa. Specimens of it were collected in Natal as early as 1904. Since then the flea has been collected all over Africa south of the Sahara and off a wide variety of hosts. It was first reported in Tanganyika in 1916.

To the south of Amani (Headquarters) the writer has collected a female at Dar-es-Salaam on March 12, 1962, a female at Morogoro, March 11, 1962, a pair at Iringa, March 19, 1963, a pair at Ifikara, April 2, 1963, and 4 ♀♀ at Njombe, March 23, 1963, all off *Mastomys natalensis* ssp. (Coucha Rat) and to the west off the same host a pair at Mamba on November 10, 1962, a ♂ and 3 ♀♀ at Korogwe, January 3, 1962, 2 pairs at Lushoto, December 23, 1961, and a ♂ and 2 ♀♀ at Gonja on November 12, 1962. *Rattus rattus kijabius* (Black Rat) carried this flea consistently at Amani. *Aethomys chrysophilus voi* (Bush Rat) carried fair numbers of it at Gonja. *Acomys albigens* (Spiny Mouse) carried a pair of this flea at Gonja on November 12, 1962.

Xenopsylla morgandaviesi Hubbard, 1963.

This representative of the *brasiliensis* group ranges west of *brasiliensis* and south of *robertsi* in the Lake Manyara National Park, the Serengeti and about the Ausha-Moshi area. The

flea seems at home on most any mouse. In Lake Manyara National Park the writer has taken it off: *Mastomys natalensis hildebrandti,* 6 ♂♂, 2 ♀♀ on January 19, 1963. *Acomys albigena,* 6 pair, October 10, 1962. *Aethomys kaiseri* (Kaiser's Bush Rat), 2 ♂♂, 5 ♀♀ on January 16, 1963. *Aethomys chrysophilus* (Bush Rat), 2 pair, January 20, 1963. *Tatera robusta vicina* (Big Gerbil), 2 ♀♀ January 16, 1963.

At Arusha on October 1, 1962 and at Seronera on October 5, 1962 a pair from *Mastomys natalensis.*

The **Xenopsylla sarodes** Complex

Xenopsylla sarodes belongs to the *brasiliensis* group. The various members of the species seem to be true parasites of the Pouched Mouse *Saccostomus.* The original description of the flea was written by Jordan in 1937 from the male taken off *Saccostomus campestris isiolae* collected in northern Uaso Nyiro, Kenya. The female was described by Smit in 1959 from materials off the same mouse but taken in Kerio Valley, Kenya, April 12, 1958. Smit examining the writer's material from Seronera determined it as new.

Xenopsylla sarodes serengetiensis Hubbard, 1963.

On October 6, 1962 three specimens of *Saccostomus campestris umbriventer* (Pouched Mouse) taken on the bank of the creek at Seronera Lodge, 10 miles south of Banagi, the Serengeti research center where the Michael Grzimek Memorial Museum is located, carried 10 ♂♂ and 14 ♀♀ of this flea. Other mice taken in the vicinity did not carry it.

Xenopsylla sarodes manyarensis Hubbard, 1963.

This flea is separated from the preceding by the 150 miles of grass plains which are the Serengeti. It is distinguished from the above by small differences in the genitalia. On January 15, 1963 a half-grown Pouched Mouse, *Saccostomus campestris umbriventer,* was taken on the top of the Rift wall above headquarters of Lake Manyara National Park. From this small

mouse were taken 45 ♂♂ and 35 ♀♀ of this flea. Several dozen other mice taken the same night in the same site did not carry it.

The **Xenopsylla debilis, humilis, difficilis** Complex of Gerbil fleas

These gerbil fleas were all originally collected by R. Kemp during his work in Kenya and Tanganyika in 1910. All belong in the *nilotica* group. So far they have only been listed from Kenya and Tanganyika.

Xenopsylla debilis Jordan, 1925.

This flea is said to differ from other *Xenopsylla* in the small size of the eye. At times as many as 100 or more of these fleas can be taken off a single gerbil. The writer has collected it from Gonja westward into Lake Manyara National Park and then north through the Serengeti. The hosts have been: *Tatera nigricauda nyama,* at Same, Moshi, Himo through the year; *Tatera robusta pothae,* at Olalaa, October 4, 1962, 2 ♂♂ 5 ♀♀; and *Tatera robusta muansae,* in the Serengeti at Seronera, October 6, 1962, 3 pair. It is not known how far to the west or south this flea ranges.

Xenopsylla difficilis Jordan, 1925.

The type host of this flea is the Blacktailed Gerbil. The flea seems to prefer this host. The writer has collected it off the same hosts as listed for *X. debilis* and from the same localities. How far into Tanganyika the flea ranges is not known. On July 24, 1962 a pair of these fleas was removed from *Gerbillus pusillus pusillus* (Pigmy Gerbil) examined at Moshi.

Xenopsylla humilis Jordan, 1925.

This gerbil flea is the most eastern recorded in the writer's records. On December 21, 1961, at Korogwe off *Tatera robusta szaythlingi,* a ♂ and 2 ♀♀. Korogwe is about 100 miles inland from the Indian Ocean and at an elevation of about 1,000 feet.

To the west the flea has been taken as far as Lake Manyara National Park and usually off *Tatera robusta vicina*. On one occasion at Moshi the flea was off *Gerbillus pusillus pusillus* (Pigmy Gerbil), a pair, September 29, 1962.

Xenopsylla raybouldi Hubbard, 1963.

Three pairs of this flea were taken off a specimen of *Tatera leucogaster cosensi* (Gerbil) at Ifikara on April 2, 1963. These are the types. No other specimens are known. Ifikara is just south of the central point of the country. The flea is something new in a *Xenopsylla* pattern.

Xenopsylla crinita Jordan and Rothschild, 1922.

This flea is thought to be a true parasite of *Cricetomys gambianus* (Giant Rat). Although there are records from several sites in southeast Kenya, from Mt. Kilimanjaro in Tanganyika and from Zanzibar, the writer has never taken it. Fifty or so of the type host examined in north-east Tanganyika failed to carry it.

Xenopsylla tanganyikensis Marcus, DeMeillon and Davis, 1960.

This flea was described from a single male taken off *Tatera taborae* (Gerbil) in central Tanganyika at the designation of Iku, Mpanda, on November 22, 1956 by Chapman and Robertson.

The authors state that it is "a species of the *cheopsis* group and related to *cheopis* (Rothschild) 1903 and *bantorum* Jordan 1938. It differs strikingly from these two species in having P^1 of the clasper parallel-sided."

The writer has not yet collected this flea.

This is the second paper on Tanganyika fleas to be published by the writer under National Science Foundation grant G-1954, sixteen others having been published on world fleas under NSF grant G14023.

Two New Braconid Parasites of the Spruce Budworm (Hymenoptera)

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The purpose of this paper is to provide names for two undescribed and rather widely distributed Braconidae that are internal parasites of the destructive spruce budworm, *Choristoneura fumiferana* (Clemens).

Apanteles absonus, new species

This species somewhat resembles *A. fumiferanae* Viereck, another widespread parasite of the same host, but it differs in many particulars, especially in having the propodeum largely smooth and without a defined areola, in the sclerotized plates of the first and second tergites being very weakly sculptured and the plate of the first narrower at apex than at base, in the considerably longer ovipositor sheath, and in the long and slender apical segments of the female antennae.

Female: Length about 2.8 mm. Face very shallowly and closely punctate; antennae slender, even the last four segments nearly or quite twice as long as broad.

Mesoscutum covered with minute, shallow, closely placed punctures; disc of scutellum smooth and polished, with only a weak suggestion of punctation; propodeum smooth and shining, without an areola but with a few weak and short raised longitudinal lines radiating from middle of apical margin; mesopleuron polished; hind coxa smooth and polished except for an elongate, somewhat flattened area on the outer upper edge toward base which has some scattered punctures; radius arising from slightly beyond middle of stigma and a little longer than intercubitus.

Sclerotized plate of first tergite narrowing slightly from base to apex, about twice as long as wide at apex and mostly smooth and shining, with only a little weak sculpture laterally on apical half each side of a shallow, poorly defined, longitudinal impression; plate of second tergite only about half as wide at base as

at apex and less than half as long as wide on posterior margin, smooth and shining except for a little weak sculpture along lateral and posterior margins; remainder of abdomen smooth and shining; ovipositor sheath much longer than hind tarsus and a little longer than abdomen.

Black; antennae, including scape, black; wings hyaline, the stigma brown and without a pale spot at base; tegulae piceous; legs yellow except all coxae, a small spot at apex of hind femur above, hind tibia broadly at apex, and the hind tarsus, which parts are black or blackish; venter of abdomen, and usually more or less of the lateral margins of the tergites, yellowish.

Male: Essentially like the female except that the abdomen is usually somewhat darker.

Type: U. S. National Museum No. 67736.

Type locality: Pagosa Springs, Colorado.

Described from the following specimens, all reared from larvae of *Choristoneura fumiferana* (Clemens): Three females, including holotype, from the type locality, June, 1964; 2 females, Allenspark, Colorado, June, 1964; 3 males, Cloudcroft, New Mexico, June, 1964; 1 female, Greenville, Maine, June 21, 1950; 1 male, Bingham, Maine, June 21, 1950; 1 male, Ashland, Maine, July 9, 1947; 1 male, Caratunk, Maine, July 6, 1948; 2 females, Rockwood, Maine, June 13, 1946 and July 9, 1948, and 1 female, Patten, Maine, July 1, 1946. Additional paratypes: 2 females and 1 male labeled "Sea View, Wash., Mar. 25, 1931, *Picea sitchensis*"; 2 females from Douglas Co., Wisconsin, May, 1956, labeled "ex boxes containing *Pinus banksiana* and overwintering budworm, also *Petrova*," and 1 female from Bayfield Co., Wisconsin, July 1, 1957, with the same rearing data.

Clinocentrus fumiferanae, new species

This is very similar to *C. tarsalis* Ashmead, from which it may be distinguished at once, however, by its conspicuously larger eyes and ocelli, much shorter ocellocular line and strongly receding temples.

Female: Length about 3.5 mm. Head a little broader than thorax, smooth and shining; face smooth, slightly broader than high from antennal foramina to base of clypeus; temples strongly receding and hardly half as wide as eyes; ocellocular line not, or barely, longer than diameter of a lateral ocellus; antennae slender, 32- to 38-segmented in the specimens examined; occipital carina complete; malar space less than half as long as basal width of mandible.

Mesoscutum smooth and polished; notauli sharply impressed and finely foveolate on anterior half of scutum, vanishing in the large, quadrate, rugulose area that occupies the median part of the posterior half of the mesoscutum; scutellar fovea very long, more than half as long as the disc of scutellum and divided by a median longitudinal septum; propodeum irregularly rugose reticulate; mesopleuron smooth and polished except for a rugose reticulate area in the anterior angle and a short, weakly foveolate longitudinal furrow below; metapleuron entirely rugose reticulate. Radius arising from middle of stigma, the first abscissa much longer than greatest width of stigma and nearly or quite as long as first intercubitus; second abscissa of radius less than half as long as third; nervulus postfurcal by at least its own length; mediella only a little longer than lower abscissa of basella, which is usually twice as long as upper abscissa.

First tergite about as broad at apex as long, closely, rather irregularly, striate, the two convergent basal keels meeting at a point on a level with the spiracles and continuing as a weak carina for a short distance; the connate second and third tergites closely, irregularly striate; the suturiform articulation distinct though weak; the following segments very short; ovipositor sheath a little longer than hind tarsus.

Yellowish brown; propodeum and first tergite usually more or less piceous; wings hyaline, the stigma transparent yellowish, nearly hyaline, its apical margins darkened; apices of hind femora and of hind tibiae and the hind tarsi infuscated.

Male: Like the female in all essential respects.

Type: U. S. National Museum No. 67737.

Type locality: Saranac, New York.

Described from the following material: Nine females, including holotype, and 1 male, all reared from *Choristoneura fumiferana* (Clemens) July, 1947, at Saranac, New York; 4 females and 1 male from the same host on *Abies balsamea,* Ely, Minnesota in June and July of various years from 1955 to 1961, and 4 females, also from *C. fumiferana* on *Abies balsamea,* in the Superior National Forest, Minnesota, 1955 and 1956.

"Prosoma sp.," Supposed Host of Torymus pilularidis (Huber) (Hymenoptera: Torymidae)

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In 1927 L. L. Huber described *Callimome pilularidis* (*Torymus pilularidis* of present terminology), reared from "*Prosoma* species on *Baccharis pilularis* De Candolle" (Proc. U. S. Natl. Mus. 70: 45). This host citation implies that *Prosoma* is some sort of gall maker on *Baccharis*. "*Prosoma* sp." as the host of *pilularidis* has been repeated in the literature several times since, although no one has been able to find that *Prosoma* is a described genus. Huber himself (p. 8), in his host list, entered *Prosoma* as "Miscellaneous." In the 1951 Synoptic Catalog of Hymenoptera of America North of Mexico (Monog. 2, U. S. Dept. Agr., p. 525), Peck repeated the host citation as originally given. In his 1963 catalog (Canad. Ent. Sup. 30, p. 550), he listed *Prosoma* as a possible *nomen nudum,* and as "Misc. insect," although he placed it in his host list (p. 995) under the plant family Compositae. Lienck (unpublished Ph.D. thesis, U. of Ill. 1951, p. 19) stated that *Prosoma* could not be found in the various indices of generic names, and he listed it as "Miscellaneous; in all likelihood a misspelling."

I also have consulted all available lists of generic names in both Zoology and Botany without finding *Prosoma* as a described genus. However, when I consulted the old Bureau of